AGRICULTURAL NEWS LETTER

VOL. 22-NO. 5

SEPTEMBER-OCTOBER, 1954

This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

DUPONT

ISSUED BY PUBLIC RELATIONS DEPARTMENT, E. I. DU PONT DE NEMOURS & CO. (INC.), WILMINGTON 98, DEL.

AGRICULTURAL NEWS LETTER

Published bi-monthly by the
Extension Division, Public Relations Department
E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Wilmington 98, Delaware

L. F. LIVINGSTON, *Manager*

R. M. ROBERTS, *Editor*

DU PONT AGRICULTURAL ADVISORY BOARD

H. F. DIETZ
Agricultural Pesticides

F. G. KEENEN
D. W. KOLTERMAN
Nitrogen Products

NELSON ALLEN
Packaging Films

JAMES WADDELL
Animal Nutrition

D. C. BOUGHTON
Animal Diseases
and Parasites

A. E. CARLSON
Weed and Brush Control

The AGRICULTURAL NEWS LETTER serves as a medium of reporting new developments and new ideas in the field of agriculture, particularly as they are related to advancements through research. Material appearing herein may be reprinted in whole or in part, in the interest of advancing the general knowledge of new agricultural practices.

This publication is available on microfilm. Beginning with Volume 17 (1949), it may be obtained in this form from University Microfilms, 313 North First Street, Ann Arbor, Michigan. The cost is $1.50 per volume, plus 10 cents for packing and mailing. All orders should be sent to Ann Arbor.

WHAT FARM EDITORS ARE SAYING --

"Agricultural research has made possible great strides in the last few years in production efficiency. Unfortunately, similar progress has not been made in distribution and marketing, although there is every reason to believe that adequate research could greatly improve efficiency in this field also." -- Tom Leadley in COLORADO RANCHER & FARMER

"Farming changes -- and so do the qualifications of a good farm hand. Brawn and endurance were once his big tests. But today they're outweighed by the need for skill, experience, and technical knowledge." -- GUERNSEY BREEDERS' JOURNAL

"One of the oppressive costs of the livestock industry is to 'live with' diseases that should have been dealt with before they got out of hand." -- Paul Johnson in PRAIRIE FARMER

* * * * * IN THIS ISSUE * * * * *

The Birth of a New Pesticide..... 82

New Plastic Wad in Shotgun Shell..... 86

Good Hunting! - - - Safe Hunting!..... 86

"Ceresan" Seed Disinfectant Fights Wheat Killer. 87

Nitrogen at Plow-Down Found to be Effective... 90

Greenhouse Covered with Polyethylene..... 92

Autumn's Best Season for Outdoor Painting.... 94

Spray Off That Paint!..... 95

Murder on the Meadow..... 96

Experimenters' Notations..100

"The greatest challenge of all time is within man himself . . . within his ability to get along with his fellow men . . . and within his power to preserve the opportunities and freedoms that have made his life what it is today." -- THE NATIONAL GRANGE MONTHLY

DR. WENDELL H. TISDALE, internationally known plant pathologist and for many years a valued member of the advisory staff of AGRICULTURAL NEWS LETTER, retired July 31 after 27 years of service with the Du Pont Company. Dr. Tisdale played a key role in the development of the dithiocarbamate and thiuramsulfide fungicides, thus opening the modern era of plant disease control through the use of organic compounds. He also developed "Lignasan" fungicide for the control of stain-producing fungi in lumber, and helped develop "Ceresan" seed disinfectant. Born in Georgiana, Alabama, Dr. Tisdale was graduated from Alabama Polytechnic Institute in 1914 with a B.A. degree in agriculture and botany. At the University of Wisconsin, he majored in plant pathology and genetics, receiving an M.S. degree in 1915 and a Ph.D. degree in 1917. Working with the USDA, he was prominent in developing controls for rice diseases and smuts of grain. He also served one year as head of the Department of Botany and Plant Pathology at North Carolina State College. Joining the Du Pont Company in 1926, Dr. Tisdale was for a number of years manager of the company's pest control research section and a pioneer in developing good relationships between industry and state and federal agricultural experiment stations. Since 1949 he has devoted much time to agricultural problems in Latin America.

THE BIRTH OF A NEW PESTICIDE

By Dr. Harry F. Dietz*
Manager Agricultural-Biological Section
Grasselli Chemicals Department
E. I. du Pont de Nemours & Company

Although we may never have thought of it, the American people are among the best fed people on earth. Each of us uses the output of at least two and a half acres of agricultural land per year in contrast to many less fortunate peoples who are thankful for the fruits of less than a single acre per capita.

It is true we are blessed with much fertile soil. We are also blessed by the results of a tremendously potent force known as technology. This has provided us with better machinery for cultivating, treating, and harvesting crops and utilizing and conserving our lands, better fertilizers and methods of applying them, and better agents for controlling those organisms which threaten our food crops during the growing and storage periods.

In spite of all the progress we have made, it is generally agreed that those organisms we call pests -- insects, plant disease-producing fungi, bacteria and viruses, weeds, and rodents -- still exact a tremendous toll, up to 15 billion dollars loss per year.

Surpluses May Be Temporary

While at the moment we may have agricultural surpluses, in the long run with our rapid increase in population it appears that within the next half century the current loss cannot be tolerated. This in itself justifies the search for new and better pest-control agents than we now have.

The advent of synthetic organic insecticides, the dithiocarbamate fungicides, and the hormone type herbicides, 2,4-D and 2,4,5-T, during and immediately following World War II opened new vistas in the possibilities of controlling pests which have plagued mankind since the beginning of history.

I would like to relate the course of development of a typical new pest-control agent from the time someone first thinks of it until it is introduced and finds its place in our agricultural economy. Certainly a chemist does not merely think up a new chemical compound or extract it from some natural source, try it against some insects, fungi, weeds or rodents and then if it works, rush in to make and sell it.

Four Phases

In the light of our ever-increasing knowledge, the steps that must be taken before any agent can be introduced are many and complex. They involve four distinct phases and the cooperative work

of men trained in a number of disciplines, namely, those of biology, of chemistry, of engineering, and of toxicology.

The first step, of course, is to find the new agent either from some natural source or from work in the laboratory. The biologist screens candidate compounds rapidly in the laboratory or greenhouse in relatively simple tests designed to pick up the slightest activity.

Once a compound has been selected as having promising activity, it is then subjected to several critical secondary screens in both the laboratory and the greenhouse from which much is learned about the quantitative biological properties such as the minimum effective concentration, spectrum of activity, and its effect on crop plants.

We are interested in superior new pest-control agents, not merely ones which are as good as and competitive with existing products.

Chemist and Toxicologist

The chemist who made or selected the candidate agent and submitted it for biological evaluation is reasonably certain of its structure, its purity and some of its important chemical and physical properties. He may have some ideas as to how safe it is to handle.

Since the secondary screens have indicated that we may have a meritorious new agent and further work is required to confirm this, more and more persons will be handling it. Therefore, we must know, not speculate or theorize, about its safety.

At this point the toxicologist enters the picture. We are fortunate in having in the Du Pont Company our Haskell Laboratory for Toxicology and Industrial Medicine to which the agent can be sent for study and for determining its effect on warm-blooded test animals by various routes of administration -- oral, skin absorption, inhalation and intraperitoneal. With such information the persons who must further evaluate it can be informed how to handle it safely.

Importance of Formulation

The next step is the small plot field test. For this purpose more material than can be prepared in the laboratory must be available and the chemical engineer is called upon to provide it because of his knowledge of larger sized equipment for carrying out the reactions required to make the product. Likewise, few candidate materials that emerge from the secondary screens can be used "as is" in field equipment. Hence, the formulating chemist is called upon to prepare the agent in a usable form such as a wettable powder, emulsifiable solution, or in other forms required by current application equipment or indicated use practices.

Proper formulation is often quite difficult and involves much more than merely mixing a few ingredients together and assuming that because the formulation disperses well in water or in oil it is ready for field testing. Not infrequently the biologist on

testing the formulation is discouraged to find that the activity of the new agent has been reduced. Hence, the reason for this must be ascertained and much valuable time may be spent on this phase of the development.

When suitable formulations are prepared, they are sent to our field investigators in the East, Midwest, West, and South for critical evaluation under use conditions. These tests are designed to pick up any weaknesses inherent in the product such as failure to perform biologically, lack of safety to crop plants, lack of the necessary residual effectiveness, or undesirable handling properties of any kind.

Analyzing Residues

Since we are interested in residual efficiency, residues on or in crop plants, or foods processed from them, and residues in soil become an important consideration. This is the province of the analytical chemist who is asked to devise as simple a means as possible whereby analytical chemists can detect the presence of micro-quantities of the new agent. Not only is a good analytical method necessary for detecting the presence or absence of the new agent, thus being a means of determining proper and safe use, but it also makes possible accurate studies on the agent's mode of action.

Field tests over a period of several years are often required to determine the real value of a new agricultural chemical for the following reasons. Climate and weather vary from year to year. Soils, crops, and farming practices also vary widely from one geographical area to another. The ecological factors in different life zones may have an unusual and unexpected influence on the response of insects, plant disease-producing organisms, and weeds, as well as crop plants, to treatment with the new agent.

Only after our own field plot tests show that the new pest-control agent has real merit do we inform state and federal investigators about it and send them sample quantities for evaluation. The data which we have developed about its biological effectiveness, relative safety to crop plants and warm-blooded animals, and residue analyses are summarized and sent to them. The new agent is now on its own to prove its merit against the best currently available products for similar use or in new uses for which no effective material is available. In the investigator evaluations not only the desirable qualities but also the limitations of the new agent are certain to be revealed.

Reviewing the Data

If it still looks highly promising or unique in the investigator tests, the chemists, biologists, and engineers carefully scrutinize all the chemical, physical, biological, and toxicological properties to be certain that no important factor which might affect its safe and effective use has been overlooked.

Its safety to warm-blooded animals by various routes of administration has been established and the amount of residues which may be expected in proper use determined through analytical methods,

but one more fact still must be established -- the maximum amount of the material that can be tolerated without injury. The toxicologist through chronic toxicity tests determines the safe amount by feeding the new agent at various levels to animals over a period from 90 days to as long as two years.

Up to this point the new agent has been given only to qualified investigators. If everyone is agreed that it really is worth while -- superior to existing products, useful in crop production or the amelioration of pest problems, can be produced and sold at an economically sound price, and is safe to manufacture and use -- then only is the new agent ready for introductory sales.

Government Requirements

Before it can be sold, the new agent must first be registered with the Pesticide Regulation Section of the United States Department of Agriculture. At this time all information which has been developed on its chemical and physical properties is submitted for scrutiny by the various biologists, chemists, and toxicologists of the Department of Agriculture and the Food and Drug Administration.

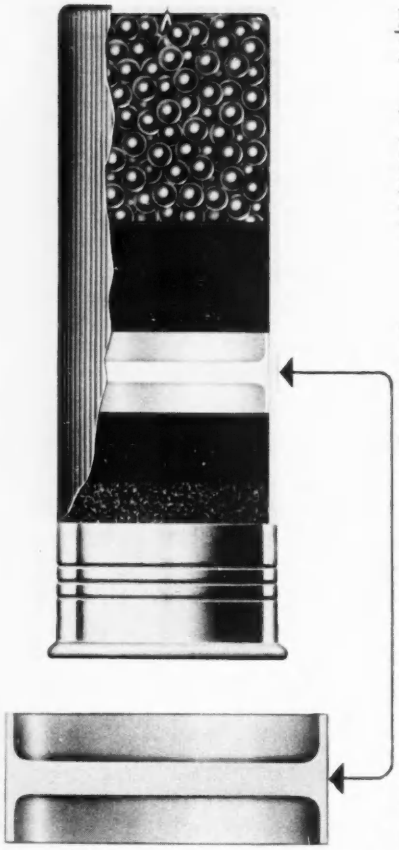
Great emphasis is laid, and rightfully so, on the proper and safe use of the new agent. The label and literature regarding it are critically reviewed, constructive changes are often suggested, and sometimes further information on one or more of the complex facets of the development requested. We believe that the whole chemical industry concurs with us that there is everything to gain and nothing to lose from such a vigorous and vigilant program which has at all times been reasonably and fairly administered by the responsible officials of the Department of Agriculture and the Food and Drug Administration. Even with Federal registration in effect, further registration also must be made in most of the states before the product can be sold within their borders.

You are now aware that all the various steps in the development of a typical new pest-control agent have required a long time, seldom less than five years, and the efforts of a host of investigators versed in the various branches of chemistry, biology, engineering, and toxicology. The amount of money spent in such development of one product is seldom less than a million dollars. This is exclusive of the money that will be spent in providing the necessary plant and equipment for its manufacture.

Even after it is introduced on a restricted basis, any new pest-control agent must be carefully and closely serviced to be sure it is used in the right amount, in the right way, and safely, to meet approved needs. Only in this way can the potentialities of a useful product be fully realized and its place in our agricultural economy established.

#######

*Editor's Note: This article is condensed from a paper by Dr. Dietz presented before the North American Wildlife Conference earlier this year.



NEW PLASTIC WAD IN SHOTGUN SHELL IMPROVES PERFORMANCE

A new development in shotgun shells which is said to reduce recoil, give a better pattern at all distances, and produce more uniformity in both impact and scatter of the shot has been developed by Remington Arms Company, through the use of a gas-sealing wad made of "Alathon" polyethylene, a tough, flexible plastic.

As shown in the diagram at left, the plastic wad is designed somewhat in the form of an "H" in cross section and forms the center of a wad column in the new shell. It rests between the springy under-the-shot wad, and over the over-the-powder wad which is impregnated with a hydrocarbon compound to lubricate the barrel.

When the shell is fired, the three wads are driven together to provide thorough gas-sealing throughout the barrel. Just as piston rings follow the contour of a cylinder, the polyethylene wad adapts itself under pressure to variations in the barrel (through the forcing cone, barrel, and choke) to eliminate any loss of power.

While applications for the new plastics, such as nylon, have become numerous in the field of sporting equipment, being used in fishing tackle, as football cleats, and even for racing shoes for horses, this is the first instance in this country where a plastic has been adapted to improve sporting ammunition. Remington engineers hail the new development as the most important advancement in shotgun-shell design since their introduction of the flat-top crimp.

GOOD HUNTING! - - - - - SAFE HUNTING!

Hunting accidents kill or injure thousands of sportsmen every year. A little care in almost every case could have prevented the mishap. The news letter of the Florida Future Farmers of America urges these precautions:

1. Treat every gun with the respect due a loaded gun.
2. Never carry a gun into your auto, camp or home unless it is empty, taken down, or with the action open.
3. Always be sure the barrel and action are clear of obstructions.
4. Always carry your gun so you can control the direction of the muzzle, even if you stumble.
5. Be sure of your target before you pull the trigger.
6. Never point a gun at anything you do not want to shoot.
7. Never leave a gun unattended unless you unload it first.
8. Never climb a tree or a fence with a loaded gun.
9. Never shoot at a flat, hard surface, or the surface of water.
10. Do not mix gunpowder and alcohol.

SNOW MOLD OF WHEAT CONTROLLED

USING "CERESAN" SPRAY TREATMENT

Snow mold -- a disease which has consistently wiped out stands of winter wheat in sections of Washington and Idaho -- seems to have been conquered through a pre-snowfall spray treatment with a chemical which wheat growers have used for many years to treat their seed.

The chemical is "Ceresan" seed disinfectant, known previously as an important weapon in the control of smut, seed rot, seed decay, and seedling blight. Results of the spray application to control snow mold were quite striking. In test fields last spring, areas treated abounded in flourishing green in contrast to patches of "moldy" winterkilled wheat where no chemical had been applied. Even where early winter snows had fallen on unfrozen ground and deep snow had remained late in the spring, sprayed wheat came through in fine shape.

Snow mold, sometimes confused with low-temperature injury, is caused by fungi that thrive under a deep blanket of snow -- particularly if snow falls before the ground freezes, after a rainy autumn. The deadly "mold" spreads over and kills blades of wheat, reducing the stand, or even wiping out the field. When such a field has to be replanted to spring wheat, the farmer faces a yield loss of sometimes as much as eight to 10 bushels per acre in addition to his replanting cost of about $3.50 per acre.

The disease is serious in wheat fields in the Douglas County area of Washington and the Fairfield, Idaho, area as well as in 13 southeastern counties of Idaho. It also occurs on wheat in Utah, and is a serious turf disease on lawns, golf greens and fairways in eastern Washington.

Possibility of chemical control of the disease is expected to be of even greater interest in areas where snow mold has been so severe year after year that farmers have had to stop trying to raise winter wheat.

Dr. Roderick Sprague, of the Wenatchee Tree Fruit Experiment Station, one of the Washington Agricultural Experiment Stations, started testing the standard "Ceresan" M seed disinfectant formulation for snow mold control in 1949. For four seasons, he has obtained good control with dry applications consisting of five pounds per acre of "Ceresan" M mixed with 40 pounds of fertilizer as a carrier. (When used for seed treatment, the per-bushel dosage of "Ceresan" M amounts to about a half-ounce.) These were applied to the young wheat in late fall before winter snows. Trials in recent years have been on the farm of Jim Petersen near Mud Springs in Douglas County.

During the 1953-54 season, six tests in the Fairfield and Tetonia areas of Idaho demonstrated effectiveness with "Ceresan" applied as a spray -- two and one-half pounds of "Ceresan" M-2X (equivalent in strength to five pounds of "Ceresan" M) in 20 gallons of

Crop loss from snow mold in an Idaho wheat field. Photo taken two weeks after snow had melted.

Close-up of wheat on the farm of Bill Simon, Fairfield, Idaho, showing the difference between wheat killed by snow mold and wheat protected with surface sprays of "Ceresan" seed disinfectant.

An extreme case of snow mold wiped out wheat in the foreground of this picture, but wheat in the background, sprayed with "Ceresan" seed disinfectant, came through nicely. (Test area at Tetonia Branch of Idaho Agricultural Experiment Station.)

Skimpy stand on the left in this picture was caused by "winterkill" due to snow mold on the farm of Levard Hansen, Fairfield, Idaho. Flourishing wheat at right was protected with the "Ceresan" seed disinfectant spray application.

water. Practically 100 per cent control of the disease was achieved, even when snow mold completely wiped out wheat in untreated areas.

The work at the Tetonia Branch Experiment Station of the University of Idaho has in previous years been confined to the effect of various cultural methods on the control of snow mold. Chemical treatments were started in the fall of 1952. Fertilizers have not proven economical at the Tetonia Station so present work has been concentrated on spray application of fungicides.

In the Idaho tests, "Ceresan" M-2X seed disinfectant was applied with a weed sprayer and "Ceresan" M, mixed with "NuGreen" fertilizer compound, was applied dry in November before snow came to stay, and results were evaluated in mid-May. H. C. McKay, superintendent of the Tetonia Branch of the Idaho Agricultural Experiment Station, arranged for replicated quarter-acre plots in front of a snow fence at the branch station. Test treatment was also applied to larger plots on the Nelson Farm which adjoins the Tetonia station property. In addition, two-acre plots were treated on the Idaho farms of Bill Simon, Levard Hansen, Max Hanson, and Harry Giesler, all of Fairfield.

In dry applications, "NuGreen" fertilizer compound, at 40 pounds per acre, has been used as a carrier for the "Ceresan." "NuGreen" has also been included in some of the mixtures when "Ceresan" M-2X has been applied in sprays for snow mold control. Thus application costs can be reduced by combining snow mold control and nitrogen fertilization in one treatment if it is desired. The addition of nitrogen in these applications helped promote recovery of injured wheat, but did not have any direct effect on the disease control.

#######

Editor's Note: A technical data sheet concerning the snow mold disease and its control is available to anyone writing AGRICULTURAL NEWS LETTER.

RESEARCH -- AND FARM PROSPERITY

Much has been written and said in the past few years regarding the way research developments in insecticides, fungicides, weed killers, and other farm chemicals have made possible the production of bigger and better crops. But little mention has been made of the way research has also been responsible for bigger and better customers for those crops.

In the past 40 years, the manufacture and sale of new products in the chemical industry has created 500,000 jobs -- jobs that didn't exist before. In the Du Pont Company, as an example, new product developments since 1931 have been responsible for 35,650 new jobs. Almost all are the result of Du Pont research programs. Here is a great reservoir of the raw material -- jobs -- from which consumer purchasing power and our healthy national economy is built.

NITROGEN AT PLOW-DOWN FOUND TO BE EFFECTIVE

In few areas of this country is the recognition of nitrogen as a vital element in economical crop production more sharply felt than in the corn regions of the Middle West where years of high crop production have notably decreased the amount of nitrogen available in the soil. Here the absence of nitrogen is often the limiting factor in the production of top yields of corn and small grains.

Recently much attention has been paid to the most effective means of satisfying this need for nitrogen in the corn belt. Research has been aimed at finding the best time and the best method for applying commercial nitrogen. A recent development is the plow-down application.

Midwestern colleges, notably in Iowa, Illinois, and Missouri, have taken a leading part in showing the effectiveness of plowing down nitrogen in the fall. Several years of testing indicate that fall applications of nitrogen offer many advantages over spring applications. For fall applications, however, it is necessary to use a form of nitrogen which is not subject to leaching before crops are established the following spring. Urea, because of its unique properties in the soil, has shown itself to be well adapted to plow-down application, whether in fall or spring.

The deeper placement of nitrogen in the plow-down method is beneficial for two reasons. Primarily, it encourages a deeper root system, enabling roots to draw more moisture from the soil. In areas where corn normally rooted itself two and one-half to three feet into the soil, it was discovered that nitrogen applied by the fall plow-down system encouraged the growth of roots as far as four feet into a clay pan. A second advantage of this deeper placement of nitrogen lies in the extensive cut-back in competition for nutrients on the part of shallow-rooted weeds.

The convenience of fall plow-down application is also considerable. During the fall season, fertilizers are more readily obtainable since there is less demand for most types, grades, and analyses. Equally, fertilizer application equipment is under a less strenuous schedule and thus more apt to be available during the fall.

Applying nitrogen at plow-down assures availability of the element when the corn or other small-grain crop requires it. This method eliminates the uncertainty of spring applications due to delays occasioned by unfavorable weather and soil conditions.

Ammonium or urea forms of nitrogen are indicated for use in plow-down since these forms resist leaching. When plowed down, nitrogen is placed with crop residues, ready to assist in early and rapid decomposition of organic matter -- a process which starts in

the fall but occurs mainly in the spring when the soil warms and micro-organisms again become active.

The effectiveness of the plow-down system becomes most apparent when its mechanics are examined closely. The cycle starts when urea, for example, is plowed under with crop residues at a time when soil temperatures are likely to remain below 57° F. The urea nitrogen is then rapidly converted to ammonium nitrogen. This ammonium form of nitrogen is fixed to the soil particles and held securely against leaching by movement of water through the soil.

Some fertilizer is converted into organic form (bacterial protein, etc.) through crop residue decomposition. Little nitrate nitrogen is formed because the nitrifying bacteria are inactive at temperatures below 57° F. Thus all converted nitrogen is found to be in leach-resistant form either as protein or as ammonium nitrogen.

Throughout most of January and February the ground is frozen. During this period there is negligible water movement or bacterial activity. However, in late winter and early spring melting snow, increasing rainfall, and low soil life activity result in a downward movement of water. At this time soluble nutrients such as nitrate nitrogen are mobile and subject to leaching, and it is for this reason that ammonium forms of nitrogen are recommended for plow-down.

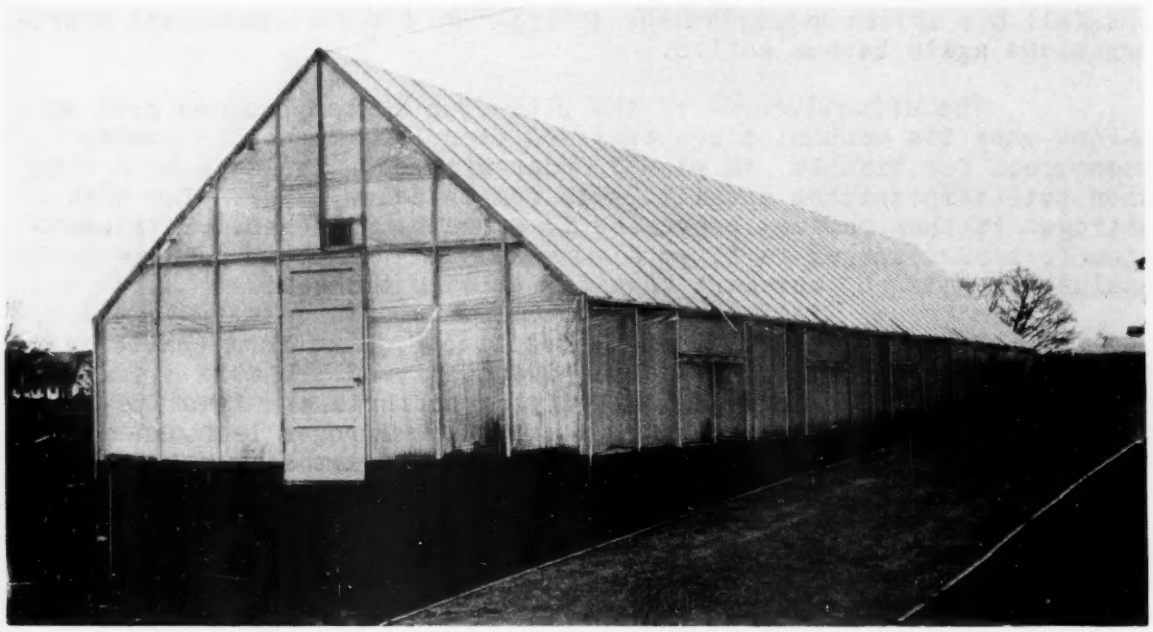
During April and early May the soil warms up sufficiently to start germination and crop growth and to resume the breakdown of crop residues from the previous year. Both these activities require nitrogen. In a situation where the supply of this element is limited it has been found that the crop, rather than the residue breakdown, is the first to suffer. Since, however, the soil in question has been fertilized with urea during the previous fall or early spring there is ample nitrogen for both the crop and for rapid residue breakdown. It should be noted here that the nitrogen temporarily tied up by the decomposed organic matter is gradually released to the crop later on and is not wasted.

When the soil temperature increases appreciably above 57° F., the nitrifiers again became active and gradually convert nitrogen in the ammonium form into nitrate nitrogen. Both these forms are then available to the crop during the growing season.

#######

Editor's Note: Du Pont's "NuGreen" fertilizer compound contains 45 per cent nitrogen, all in the form of urea, and is properly conditioned for maximum efficiency in plow-down application.

ALFALFA ADVANTAGES -- In Illinois tests during two dry seasons, alfalfa plantings have produced good crops when other legumes failed. The deep tap roots of alfalfa help open tight soil so air and water can get in. These roots can drill into subsoil and tap reserves of water and plant food that red clover roots never reach. When organic matter these roots supply is digested by soil organisms, fertility is built and structure and drainage improved.



The University of Kentucky horticulture department built this frame greenhouse and covered it with polyethylene film. The inexpensive structure, heated by bottled gas, has shown good results in holding heat and moisture, spurring plants to vigorous growth.

UNIVERSITY OF KENTUCKY BUILDS A GREENHOUSE COVERED WITH POLYETHYLENE

A practical, easy-to-build and inexpensive greenhouse now is within the reach of home gardeners and commercial gardeners alike. It is a frame of two-by-two inch wooden pieces; four-by-four inch end and side posts, for extra strength; and long, easy-to-handle rolls of polyethylene film.

Dr. E. M. Emmert, University of Kentucky horticulturist, did most of the experimental work on the one he now uses at the horticultural department. Dr. Emmert has found that, in addition to being low in cost, the 84-foot long greenhouse stands winter weather exceedingly well, it is easy to build and vegetative growth under the polyethylene appears to be better than under glass.

Using farm labor, the 18-foot by 84-foot building was framed in four days. An additional two days' time for two men was necessary for covering with polyethylene. Total cost, for materials, was $250. This price does not include installation of a heating system.

A double envelope of the film was used. The exterior "plastic siding" is of polyethylene 0.002 inches thick. The interior siding is of sheets 0.0015 inches thick. The air space between the two sheets, about two or three inches, acts as an insulator blanket.

A similar size, conventional "glass" greenhouse would cost between $8,000 and $9,000.

Dr. Emmert got his first plastic greenhouse into operation by using LP (bottled) gas as the heating fuel. The gas stimulated vegetative growth by giving off carbon dioxide. The greenhouse is amenable

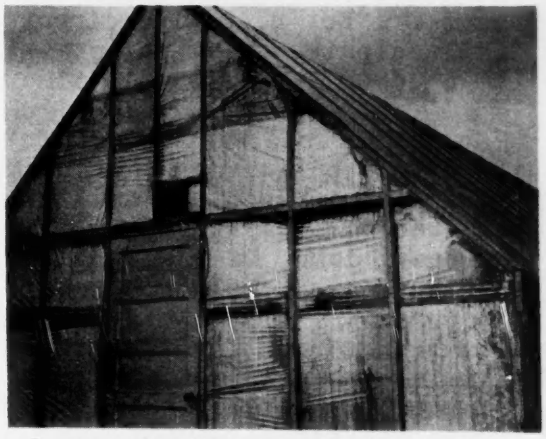
to any type heat a gardener might want to use -- except an open, natural-gas burner.

After the framing was completed, two men attached the film. The University bought polyethylene rolls in 56-inch width. This was laid lengthwise on the building. Each successive layer of film was "lapped" under the one above, for a good seal; and as each roll was applied, it was stretched tight to prevent sagging and buckling. Each roll was held in place by lathing strips, tacked at right angles to the length of the roll as it was unrolled. These laths were left loosely tacked at the point where the next (and lower roll) was slipped under for lapping.

Dr. E.M. Emmert, University of Kentucky horticulturist, who designed the polyethylene-covered greenhouse, here kneels beside one of the burners inside the structure. Around him are tomato plants recently started. A bumper crop of lettuce was also grown in the house. Dr. Emmert believes that the carbon dioxide emitted by heating units has helped vegetative growth considerably.

The film costs an estimated six-tenths of a cent a square foot for the 0.002-inch type; 3,000 square feet were used outside.

The greenhouse will stand rain, snow, hail, and sleet very well, but in hot sunlight the film eventually degrades, and it should be replaced annually. This is no problem because it is easy to handle and the cost is not excessive. In Kentucky, gardeners are advised not to apply the film before October 1, nor after hot weather has set in.



Louvers in the gable ends were found necessary after the first structure was built without them. The greenhouse was so tightly sealed that gas burners were extinguished as the oxygen supply was depleted.

While the vegetative growth under the polyethylene shows improvement over glass or other types of films, it was found that blooming of tomatoes, for instance, was delayed about a week. This was due to the fact that polyethylene does not admit as much light as glass. However, from earlier experiments it was found that more of the heat was retained than under glass. Using the double layer of polyethylene proved about half as expensive to heat as under only a single layer -- or than under glass.

Dimensions of the greenhouse: Length -- 84 feet; width -- 18 feet; height (at peak) -- about 10 or 11 feet; height at eaves -- four and one-half feet; pitch of roof -- 40 degrees. The polyethylene used was supplied by the Du Pont Film Department.

#####

Editor's Note: The article above originally appeared in the Lexington, Kentucky, HERALD-LEADER and is reproduced here in excerpted form with the permission of that publication. Photos courtesy HERALD-LEADER.

AUTUMN'S BEST SEASON

FOR OUTDOOR PAINTING

Fall is gaining favor as the best season for painting -- be it houses, barns, or fences.

For one thing, autumn weather is more predictable. There is less chance of a sudden shower to raise hob with a still tacky paint job. Bugs, too, are not nearly so prevalent or so active in the fall. This fact doubly recommends itself, for swarming insects not only can mess up wet paint in a hurry but the painter also runs less risk of being stung by bees and wasps which jealously regard cornices and eaves as private property. Mosquitoes, also, are usually less bothersome in the crisp late season air.

Temperatures in most sections of the country make for better exterior painting when it is about time to take down the screens. Preferred temperature range is between 60 and 80 degrees, says Dr. Roy B. Davis, director of Du Pont's paint laboratory in Philadelphia. He also notes that wood moisture content is usually at a lower level at this time of the year than in the spring.

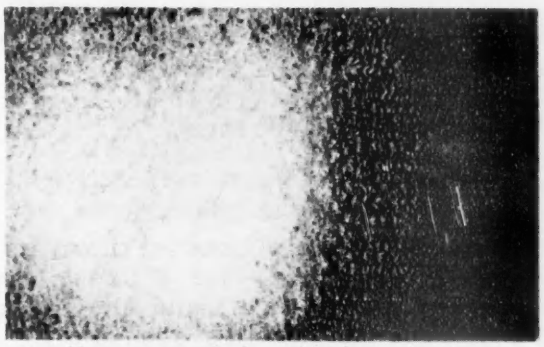
Cold weather impedes "flow" and "leveling" of paint, setting up a pull under the brush that will make the huskiest painter arm-weary in short order. Hot sun, on the other hand, may cause blistering. One thing to watch for in late autumn painting programs is heavy dew. In the morning, operations should be put off until surfaces are completely dry.

Rural brush wielders are also advised to give more than passing thought to the type of material selected for their job, especially white exterior paint. Generally speaking, there are two types available and each has its distinct place in the paint picture. Especially designed for all-frame buildings is self-cleaning white paint, which stays white longer. This is so because it is formulated in such a way that a fine powder forms on the surface of the paint film and is washed away by rainfall, taking accumulated dirt with it. Self-cleaning paint also provides a superior surface when repainting is in order.

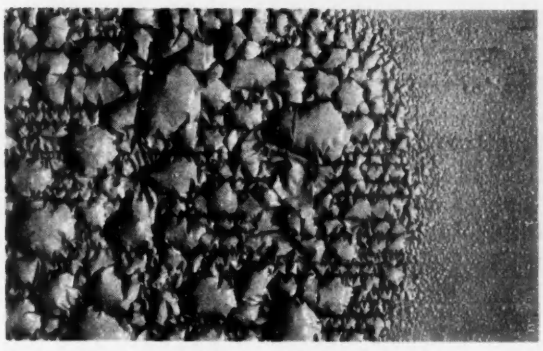
However, wooden areas of masonry buildings as well as trim on buildings painted in color should be painted with a white of the very slow-chalking variety. Don't forget, there is a difference between exterior paints in tints and colors, and trim and shutter paint. Each is chemically engineered for its purpose and should not be interchanged or intermixed.

Since paint weathers more rapidly on one side of a building than another, two coats may be required on, say, the south side, where one may be ample for other exposures. Finally, it's the falsest economy to slight proper cleaning and other preparation of surfaces to be painted. That's the key to good paint performance.

Sprays on with push of button.



Note blistering around edges of froth as solvent goes to work.



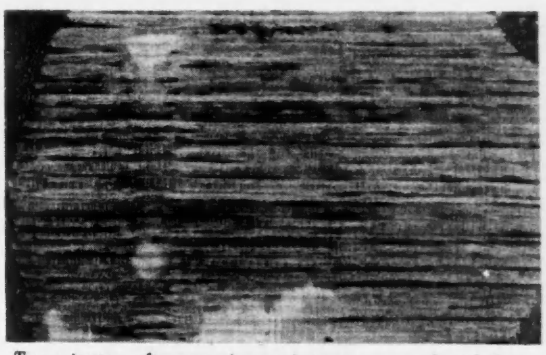
Within three minutes after application, paint in this test showed this blistering, resulting from solvent in the spray

SPRAY "OFF" THAT PAINT!

Whether it's a barn or a kitchen chair you're painting, the application of paint, varnish, or lacquer by various types of spraying equipment -- from compressed air machinery to aerosol cans -- has become a well accepted painting method. Recently, however, Du Pont chemists developed a formula which can be sprayed on a painted surface from an aerosol container to remove most any type of finish.

Paint can be removed more rapidly, and with the expenditure of less "elbow grease" using the spray-on paint remover, as compared with conventional materials that are brushed or rubbed on. In many cases the aerosol solvent results in a cleaner job, too. Pictures on this page illustrate the way in which this frothy material loosens the paint film.

The Du Pont Company has offered the formula for this new paint remover to any packagers and marketers of aerosol products, free of any charges or restrictions. Several of these firms are about to introduce the product under their own brand names.



Ten minutes after spraying, paint was removed with the edge of a cardboard box. Normally a putty-knife job.

MURDER ON THE MEADOW,

OR THE CASE OF TEN MILLION SHEEP KILLERS

By Dr. D. C. Boughton*

When primitive man first brought sheep down from the hills to his campfires on the plains, he brought their internal parasites too. Man has been cultivating these parasites successfully ever since -- through the early stages of domestication of their hosts and on into the latest refinements of sheep husbandry. It is really no joke at all that if we had set out to domesticate the parasites instead of the sheep we couldn't have done a much better job than we've actually done as it is without half trying. It has been a practice -- not only in the sheep industry but in other livestock industries as well -- to raise our domestic animals and their parasites together as one operation.

Parasite-free domestic animals do not exist. We've been interested in developing the sheep, but we've not shaken them free of their parasites, so to speak. It's much as if a desirable grain, originally closely allied in the wild state with undesirable species of weeds, had been coddled and cultivated down the years without being separated from those weeds.

The United States Department of Agriculture has compiled statistics for nearly a century of sheep raising in this country. The average annual sheep population over this period is 45 million head. Let me give you some statistics on their parasites.

Parasite Statistics

I'll confine my figures to the tiny little beasts known as gastrointestinal nematodes -- omitting the tapeworms, the flukes, the lungworms, the bots, and keds, the lice, the screwworms, and the ticks which are also part of the walking menageries we know as sheep.

These stomach and intestinal worms are less than an inch long and no thicker than an A-string of a ukulele. Individually they are so small it takes over 100,000 of them to weigh a pound; collectively they are a powerful drag on the sheep industry.

If we set the average infection per head per year at a conservative 1,000 worms, then our annual production is 45 thousand million worms. In the last hundred years we have reared to maturity four and one-half million million worms, or 20,000 tons of the descendants of the parasites on hand at the beginning of the War Between the States.

Half of these worms have been busy females. During the years they have propagated to the tune of 135 billion million microscopic worm eggs, having a total weight of 10,000 tons, which have been scattered far and wide across our grazing lands in the droppings of their hosts. In a century of sheep raising in this country

we've produced some 30,000 tons of gastrointestinal roundworms. This tonnage can be visualized as a flock of 1,000,000 sixty-pound lambs.

Worms Not Like Bacteria

In coping with disease due to worms, we should keep in mind a significant difference between it and typical bacterial diseases. When bacteria invade the body of an animal, they multiply their numbers in the body, and, if disease develops, it does so as a result of this multiplication.

The parasitic worms with which we are concerned here, on the other hand, do not multiply when they invade an animal. If I feed a susceptible lamb 100 infective larvae of the common stomach worm, then I can expect to recover later on postmortem examination no more than 100 adult stomach worms. From one infective baby worm can develop only one adult. Each worm can do only as much harm as it is capable of doing in its own right -- but no more. It can suck blood, produce a toxin, or open a minute hole for secondary bacteria in the lining of the digestive tract -- but what sheep would be worried by one worm? One worm wouldn't even tickle. Large numbers of worms would produce a large amount of damage.

When I say worms do not multiply like bacteria within the body of the host, I do not mean to imply they don't propagate. On the contrary, they are very prolific. However, they reproduce in the self-respecting manner of higher animals -- that is, by bisexual reproduction -- and have the good grace to see to it that their eggs leave the host promptly. Mature males and females mate, and thereafter some 60,000 fertilized eggs per female are discharged into the food mass in the digestive tract of the host, to be passed out onto the pasture in the droppings. The eggs hatch into baby worms, which are picked up by grazing sheep to begin again the parasitic phase of the cycle.

Contaminating the Pasture

Suppose a healthy ewe is carrying a moderate infection of stomach worms. She isn't sick, nor will she experience a disease crisis. The herdsman doesn't recognize that he has a disease condition on his hands. Yet this healthy-looking ewe is really, in a sense, in the incubation state of disease. The worms in the ewe are shedding enormous numbers of eggs onto the pasture. The disease thus brewing in the ewe will break out not in her but in her lamb -- when it in turn becomes infected from the pasture its mother has contaminated.

Three practical points become evident when one gives careful consideration to the manners in which stomach and intestinal worms cause disease:

1. The disease is a sneaky one that may incubate unseen in apparently healthy animals during the early stages of an outbreak.

2. In passing from one sheep to another, the parasites have to spend time outside the host as non-parasitic, immature worms. These are my murderers on the meadow.

3. Acquired immunity to worm disease is not as clear-cut and precise as it is to bacterial disease.

From these points one concludes that parasite control should involve the early apprehension of the murderers while they're hiding out (as reproducing adults) in healthy-looking hosts or while they're slithering around on the pasture as infective larvae. This is to say that control should be by prevention. One concludes also that it will not be easy to make practical use of acquired immunity. Drugs will probably be a better bet than vaccines.

Immunity?

I don't mean to pass over immunity to worms too lightly. It is well known that parasitic worms elicit immune responses in their hosts, to the point of "self-cure" and protection from reinfection in some instances. No doubt sheepmen would welcome a cheap vaccine, but we can't expect one in the near future. For one thing, there are several antigenically distinct species of worms involved, and an effective vaccine would necessarily have to be a complex one.

Neither can we make much practical use of naturally acquired immunity in raising lambs, for example. Certainly, no one but a very desperate parasitologist would recommend that lambs deliberately be allowed to experience severe infections to develop immunity. Such a practice would be risky and expensive. In my opinion, immunity to animal parasites has no real place in those phases of livestock production in which emphasis is upon rapid growth and early marketing of young animals. Broiler and lamb chop production would be examples. To recommend the use of naturally acquired immunity is to admit we don't know anything very sensible to do. To count on it is to flaunt a false hope.

With no vaccines in prospect and with naturally acquired immunity of little practical use, we are fortunate to have a drug like phenothiazine available to help cut down the losses from internal parasites. Of particular significance is its capacity, when fed at low levels to sheep and cattle, to suppress egg production of female worms and to inhibit development of eggs passed out onto the pasture. This is indeed a remarkable property, which one cannot really appreciate fully until he has cultured the droppings of infected ruminants receiving small daily doses of phenothiazine and noted the striking reduction in living larvae as compared with similar cultures from animals receiving no drug.

Selective "Spray" Program

This is really a sort of pin-point pasture spraying to control parasites, the spray machine being the animal itself. The drug is thoroughly mixed with the parasite eggs inside the host and is laid down on the pasture at exactly the right spot to hit the parasites the hardest. This is usually accomplished in the sheep industry by free-choice phenothiazine-salt mixtures. Phenothiazine, as you know, is also effective as a therapeutic treatment for removing adult worms.

I believe we all recognize the need for more scientific

facts to help solve many remaining practical problems. Some worm species are harder to remove than others, for example. Just how long will a permanent, possibly crowded, pasture remain infective? Is there a significant seasonal cycle to watch out for? How does the average nutritional level in this area influence the severity of parasitism? Some of these things will have to be checked by research.

However, the broad features of a sensible parasite control program for the sheep industry stand out clearly. Actually the sheep industry is better off, as far as parasite control is concerned, than some of the other livestock industries. One good reason is that sheepmen fully recognize the gastrointestinal worms as the murderers of their sheep and destroyers of their profits. They know where to look for these scoundrels -- on the pasture. And they have a weapon -- phenothiazine -- with which to destroy them.

#######

*Editor's Note: Dr. Boughton is technical advisor on the Du Pont Company's animal industry products. This discussion is condensed from a paper presented by him at the annual short course on sheep production of the University of Georgia.

2,4-D TO CONTROL SPUD DISEASE?

The application of 2,4-D to young potato plants seems to show promise of controlling verticillium wilt, according to information from the Connecticut Agricultural Experiment Station at New Haven. The weed killer was applied in early June, when potato plants were six to eight inches high. There was an initial stunting and plants produced a shoe-string leaf. The potatoes grew out of this stage within a few weeks, however, and made normal development. Symptoms of the wilt -- one of Connecticut's more serious potato diseases -- were considerably less on sprayed plants than on unsprayed. This treatment is strictly experimental and not to be recommended for commercial use -- particularly since the yield will not be known until potatoes are dug in the fall. The treatment grew out of an earlier successful experiment with 2,4-D to control fusarium wilt of tomatoes in the greenhouse.

CORN SILAGE EVALUATION -- Researchers in dairy cattle nutrition at Michigan State College have been delving into the milk producing potential of that good old standby in the cow's winter diet -- corn silage. They say seven and a half pounds of good quality corn silage is equal to a pound of U. S. No. 2 corn in the dairy ration. They also find it takes just 12 days of corn silage feeding to bring cows to a peak in milk production after they are "worn down" on a straight hay diet.

EXPERIMENTERS' NOTATIONS

A Round-up of Data from Across the Nation

Flowers which remain attached to the pickle when it is placed in the brine for processing may be the principal source of molds which soften pickles and cause the pickle industry losses amounting to about $2,000,000 a year, according to recent USDA research. Heavy mold populations are built up in the growing cucumber, particularly in the flower, during harvest season. When flower-free, thoroughly washed cucumbers were used for pickling, enzyme activity was low and the cured stock was exceptionally firm, researchers reported.

#########

Two hundred seventy-one cases of parasitism in cattle, brought to the attention of the School of Veterinary Medicine at Athens, Georgia, in 1952, ran up an average loss in weight, livestock, and veterinary bills of $28.47 per head, according to a recent report from that institution. Figured in this average was the death of 20 of these parasitized animals. The cost of treating the cases that recovered was only $4.09 per animal. These figures point up the economic importance of new feeding practices in which daily low-level dosages of phenothiazine, combined with periodic drenches with the same drug, are found to protect herds from such costly parasitism.

#########

The University of Missouri recently reported on a fencepost treating experiment which has extended over the past seven years. Fourteen types of treatment were evaluated. The most successful were: (1) creosote used by the hot and cold bath method, and (2) zinc chloride applied either by soaking or with a section of tire tube strapped around one end of an inclined post so the chemical could flow through the wood by gravity. Particularly in the case of basswood, a soft hardwood, the zinc chloride treatment was more effective than any other preservative application and all treated posts lasted more than 10 years. One popular belief was exploded when the experiment showed no apparent relationship between durability of the post and number of annual rings in the outside inch of the tree, or total number of growth rings.

#########

Radioactive fertilizers are being used to determine what grasses will best withstand drought conditions. Year-old cubes of sod of various varieties are being planted in soil which has been treated with radioactive phosphates placed at various depths. The progress of individual root systems can be checked by determining with a Geiger counter when the sap becomes radioactive.

Better Things for Better Living
. . . through Chemistry

A-7936 PRINTED IN U. S. A.